CLAIMS

We claim:

1. A method, comprising:

receiving one or more demands for service in a mesh network, which network comprises a plurality of nodes interconnected by a plurality of links; and

mapping each of the one or more demands onto a primary path and a restoration path in the network to generate at least one path plan for the one or more demands in the network, wherein the at least one path plan is generated as a function of (a) one or more cost criteria associated with the at least one path plan and (b) a failure-related cross-connection criterion associated with the path plan.

2. The invention of claim 1, wherein the at least one path plan is generated by:

calculating a first set of one or more path plans that satisfy the one or more cost criteria;

calculating a second set of one or more path plans that satisfy the failure-related cross-connection criterion;

determining whether the first and second sets have any path plans in common; and

if not, then, until the first and second sets have at least one path plan in common, relaxing the one or more cost criteria and recalculating the first set.

3. The invention of claim 2, wherein the failure-related cross-connection criterion specifies a maximum number of cross-connections that are changed in any node in the network following a failure in the network.

4. The invention of claim 2, wherein the one or more cost criteria are a function of at least one of sharing degree, administrative weight, link utilization, and available capacity.

5. The invention of claim 1, wherein the at least one path plan is generated by:

(a) calculating a set of node-disjoint path pairs for the one or more demands based on the failure-related cross-connection criterion, wherein a node-disjoint path pair is calculated for each demand;

(b) identifying primary and restoration paths for each node-disjoint path pair in the set to generate a path plan for the one or more demands;

(c) determining whether the path plan satisfies the failure-related cross-connection criterion;

(d) saving, when the path plan satisfies the failure-related cross-connection criterion, the path plan;

(e) repeating steps (a)-(d) to generate two or more path plans that satisfy the failure-related cross-connection criterion; and

(f) selecting one of the path plans based on the one or more cost criteria.

6. The invention of claim 5, wherein, when the path plan satisfies the failure-related cross-connection criterion, steps (b)-(d) are repeated with a constraint that excludes each and every saved path plan.

7. The invention of claim 6, wherein steps (b)-(d) are repeated only until the path plan fails the failure-related cross-connection criterion.

8. The invention of claim 5, wherein, when the path plan fails the failure-related cross-connection criterion, steps (a)-(d) are repeated with a constraint that excludes each set of node-disjoint paths.

9. The invention of claim 8, wherein, when calculating a set of node-disjoint path pairs for the one or more demands per step (a) fails to find a feasible solution, the failure-related cross-connection criterion is relaxed.

10. A path manager for a mesh communications network, the manager comprising one or more computing elements, wherein the manager is adapted to:

receive one or more demands for service in the mesh network, which network comprises a plurality of nodes interconnected by a plurality of links; and

map each of the one or more demands onto a primary path and a restoration path in the network to generate at least one path plan for the one or more demands in the network, wherein the at least one path plan is generated as a function of (a) one or more cost criteria associated with the at least one path plan and (b) a failure-related cross-connection criterion associated with the path plan.

11. The invention of claim 10, wherein the at least one path plan is generated by:

calculating a first set of one or more path plans that satisfy the one or more cost criteria;

calculating a second set of one or more path plans that satisfy the failure-related cross-connection criterion;

determining whether the first and second sets have any path plans in common; and

if not, then, until the first and second sets have at least one path plan in common, relaxing the one or more cost criteria and recalculating the first set.

12. The invention of claim 11, wherein the failure-related cross-connection criterion specifies a maximum number of cross-connections that are changed in any node in the network following a failure in the network.

13. The invention of claim 11, wherein the one or more cost criteria are a function of at least one of sharing degree, administrative weight, link utilization, and available capacity.

14. The invention of claim 10, wherein the at least one path plan is generated by:

(a) calculating a set of node-disjoint path pairs for the one or more demands based on the failure-related cross-connection criterion, wherein a node-disjoint path pair is calculated for each demand;

(b) identifying primary and restoration paths for each node-disjoint path pair in the set to generate a path plan for the one or more demands;

(c) determining whether the path plan satisfies the failure-related cross-connection criterion;

(d) saving, when the path plan satisfies the failure-related cross-connection criterion, the path plan;

(e) repeating steps (a)-(d) to generate two or more path plans that satisfy the failure-related cross-connection criterion; and

(f) selecting one of the path plans based on the one or more cost criteria.

15. The invention of claim 14, wherein, when the path plan satisfies the failure-related cross-connection criterion, steps (b)-(d) are repeated with a constraint that excludes each and every saved path plan.

16. The invention of claim 15, wherein steps (b)-(d) are repeated only until the path plan fails the failure-related cross-connection criterion.

17. The invention of claim 14, wherein, when the path plan fails the failure-related cross-connection criterion, steps (a)-(d) are repeated with a constraint that excludes each set of node-disjoint paths.

18. The invention of claim 17, wherein, when calculating a set of node-disjoint path pairs for the one or more demands per step (a) fails to find a feasible solution, the failure-related cross-connection criterion is relaxed.